Sampling: Nyquist Frequency and Alias Frequency

Nyquist frequency of a sampling rate, the frequency a signal appears at after sampling (alias), and the lowest sampling rate for a signal bandwidth.

Method: Nyquist–Shannon sampling theorem

Input parameters

Unit system: SI

Parameter	Value	Unit
Sampling rate	10.000	Hz
Signal frequency	13.000	Hz
Highest frequency of interest	2.0000	Hz

Calculated results

Parameter	Value	Unit
Nyquist frequency f_s / 2	5.0000	Hz
Apparent (alias) frequency	3.0000	Hz
Lowest sampling rate for the bandwidth 2B	4.0000	Hz

Notes for this case

- The signal is above the Nyquist frequency: it appears at the alias frequency. Filter it out before sampling.

Formula and method

$$f_N = \frac{f_s}{2}, \quad f_a = |f - k f_s|, \; k = \mathrm{round}(f/f_s), \quad f_{s,min} = 2B$$

Variables

f_s	Sampling rate	1/s
f	Signal frequency	1/s
B	Highest frequency of interest	1/s
f_N	Nyquist frequency f_s / 2	1/s
f_a	Apparent (alias) frequency	1/s
$f_{s,min}$	Lowest sampling rate for the bandwidth 2B	1/s

Method and standards

Sampling theorem.

Assumptions and limits

- Ideal sampling.

References

- Nyquist–Shannon sampling theorem

Report details

Report reference	FCC-FXRR-XV9P (the same inputs always give the same reference)
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Calculator	Sampling: Nyquist Frequency and Alias Frequency
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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/signals-calibration/nyquist-aliasing

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.